Career Academy Integrated Unit Plan

Academy Name: Sports Science/EMS & Marketing_ **School:** _Pine Ridge High_

Integrated Unit Plan Title: ENERGY
Courses to integrate: English I, Biology, Sports Marketing I, Health & Personal Fitness
Grade Level: 9th
Timeline & Duration: 3 blocks or 4 ½ hours for Biology

Unit Summary: The student recognizes that energy may be changed in form with varying efficiency. (SC.B.1.4)

Overview of Activities/Lessons per Course				
Course	English I	Biology	Sports Marketing I	Health & Personal Fitness
Activity/Lesson		Energy flow through an ecosystem/Food chains and food webs/ Observing plant detritivores		
Activity/Lesson		Energy transfer/ Energy pyramids and trophic levels/ Calorimetry lab		

Lesson Instructions for _Biology_________________ (course):

Standards (Performance Tasks or Course Frameworks or Sunshine State Standards): SC.B.1.4.1 (AA) Student understands how knowledge of energy is fundamental to all the scientific disciplines (e.g.. the energy required for

biological processes in living organisms and the energy required for the building, erosion, and rebuilding of the Earth). **SC.B.1.4.2 (AA)** Student understands that there is conservation of mass and energy when matter is transformed. **SC.B.1.4.7 (CS)** Student knows that the total amount of usable energy always decreases, even though the total amount of energy is conserved in any transfer. **Rigor & Relevance (quadrant): B**
Instructions to Teacher: Students will draw simple food chains in class and create a food web that might exist in their schoolyard or in their own yard.
Instructions to Students: (In class) After discussing energy flow in an ecosystem, create a graphic organizer that summarizes the flow of energy from producers to herbivores, ominivores, carnivores, and detritivores. Draw two simple food chains. (Independent work) Cut out pictures and paste together a complex food web that you might find in the schoolyard or in your own yard.
Instructions for Student Accommodations:
Assessment for Activity: Students must have producers and 3 to 5 consumers in the food web. Arrows must correctly reflect the direction of energy flow.
Approximate Length of Time for Activity: 1 ½ hours
Materials Needed: white paper, glue, scissors, old magazines
Resources Needed: text (as a reference)
Attachments: n/a

Lesson Instructions for _Biology_________________ (course):

Standards (Performance Tasks or Course Frameworks or Sunshine State Standards): SC.B.1.4.1 (AA) Student understands how knowledge of energy is fundamental to all the scientific disciplines (e.g.. the energy required for biological processes in living organisms and the energy required for the building, erosion, and rebuilding of the Earth). **SC.B.1.4.2 (AA)** Student understands that there is conservation of mass and energy when matter is transformed.

Rigor & Relevance (quadrant): D
Instructions to Teacher: Collect some leaf litter that has been moist for some time and observe under dissecting microscopes for signs of mold. Students will describe what role mold plays in a forest ecosystem (i.e. breaking down leaves and other plant debris to organic molecules – energy is returned to the system).
Instructions to Students: Wearing gloves, the teacher will escort you to collect some moist leaves on campus. Place your sample in a Petri dish and observe under a dissecting microscope. Identify the mold; describe its role in the forest ecosystem (flow of energy); identify which kingdom mold belongs in. Predict what would happen if there was an increase/decrease in the numbers of this organism.
Instructions for Student Accommodations: If students are physically unable to gather sample, teacher will acquire samples for them.
Assessment for Activity: Students will be assessed on their safety techniques, clear description of mold's role, and correct classification of mold (i.e. Kingdom Fungi). Students must explain that an increase/decrease in detritivores would through off the balance (homeostasis) of the entire forest ecosystem.
Approximate Length of Time for Activity: 1 ½ hours
Materials Needed: dissecting microscopes, gloves, Petri dishes, text (reference)
Resources Needed: text (reference)
Attachments:

Lesson Instructions for _Biology_________________ (course):

Standards (Performance Tasks or Course Frameworks or Sunshine State Standards): SC.B.1.4.1 (AA) Student understands how knowledge of energy is fundamental to all the scientific disciplines (e.g.. the energy required for biological processes in living organisms and the energy required for the building, erosion, and rebuilding of the Earth). **SC.B.1.4.2 (AA)** Student understands that there is conservation of mass and energy when matter is transformed. **SC.B.1.4.7 (CS)** Student knows that the total amount of usable energy always decreases, even though the total amount of energy is conserved in any transfer. **MA.B.2.4.2,MA.B.4.4.2,MA.E.1.4.1, MA.E.1.4.3**

Rigor & Relevance (quadrant): D
Instructions to Teacher: Review the law of thermodynamics, energy transfer, and energy pyramids, and photosynthesis. The calorimetry lab will demonstrate the amount of energy trapped in food.
Instructions to Students: After discussion on energy, draw and energy pyramid and identify where humans would be located. Explain why the levels are limited. Follow up with Calorimetry lab to measure the energy trapped in different types of macromolecules and answer the discussion questions.
Instructions for Student Accommodations: as needed
Assessment for Activity: students will be assessed on procedures, safety, and discussion questions.
Approximate Length of Time for Activity: 1 ½ hours
Materials Needed: Scales, food, cork, aluminum foil, metal pin, matches, ring stand and clamp, test tubes, thermometer (or CBL thermometer, safety goggles.
Resources Needed: lab paperwork, scales, matches, ring stand and clamp, test tubes, scales, safety goggles.
Attachments: Copy of Calorimetry lab procedures and discussion questions.

Duplicate as needed.

BIOLOGY LAB

CALORIMETRY

INTRODUCTION:

Plants have evolved processes that convert light energy into the chemical bonds of complex molecules. The chemical bonds in carbohydrates, fats, and proteins store energy until needed by the plant. The plant can then release the energy by breaking the appropriate chemical bonds.

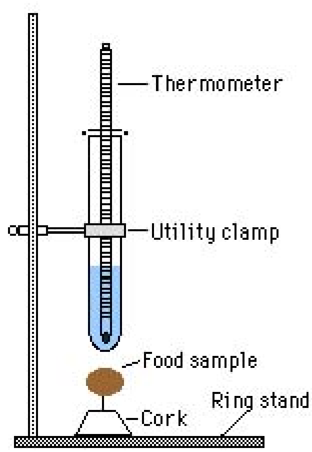
Every animal maintains its life processes by consuming complex molecules that store energy. The processed plants and animals we eat as foods contain varying amounts of proteins, carbohydrates, and fats. Because each of these types of foods contains varying amounts of energy, these foods will release varying amounts of energy when they are used by cells. Within our bodies, the energy is released slowly by a series of chemical reactions.

PRE-LAB PREPARATION:

By burning pieces of food, the chemical energy stored in molecular bonds is released as heat and light. The heat can be measured in units called **calories**. A calorie is the amount of heat (energy) required to increase the temperature of one gram of water by one degree C. This process is the basis of the technique of **calorimetry**.

The more calories a food contains, the more heat is given off when burned. Foods high in calories will release large amounts of energy. One gram of a protein will release far fewer calories than one gram of fat. You will study foods with different proportions of protein, fats, and carbohydrates to see how much energy (calories) they release.

MATERIALS:



Test Foods	Test tube (18 x 150 mm)
Balance	25-mL Graduated cylinder
Utility clamp	Large cork with pin
Ring stand	Matches

Thermometer   Distilled water

PROCEDURE:

1. Assemble the ring stand and clamp so that a test tube placed in the clamp will be one cm above the food sample (see drawing).

2. Place **15.0 mL** of water in the test tube and put the test tube in the clamp. Place the thermometer in the test tube.

3. Obtain a 1 to 3 g sample of test food number 1. Find the mass of the test food sample to the nearest **0.01 g** (two decimal places), and record its name and mass in the **DATA TABLE**.

4. Measure the temperature of the water in the test tube to the nearest **0.5 degrees C** and record in the **DATA TABLE** as initial water temperature.

5. Use the pin to affix the sample to the cork. Place the cork on the table away from the test tube. Then strike a match and set the food on fire. Immediately move the sample under the test tube. **Gently** stir the water with the thermometer, using an up and down motion.

6. After the food sample is completely burned, measure the temperature of the water again to the nearest **0.5 degrees C**, and record in the **DATA TABLE** as final water temperature. **Be sure to watch the thermometer carefully, to catch the highest temperature reached.**

7. Find the mass of the sample remaining to the nearest **0.01 g** and record in the **DATA TABLE** as mass of sample after burning (ash weight).

DATA TABLE:

Test food # ____

Food name: ____________________________

Mass of sample before burning. _______ g	Initial water temperature. _______ °C
Mass of sample after burning (ash weight). _______ g	Final water temperature. _______ °C

CALCULATIONS:

8. Subtract the mass of the sample after burning (ash weight) from the mass of the sample before burning. This is the change in mass.

Change in mass = ________ g

9. Calculate the change in temperature for the water by subtracting the initial water temperature from the final water temperature.

Change in water temperature = ________ ^{o}C

10. To estimate the calories in the food sample you will need the mass of the water you heated. By definition the density of water is 1g/mL, so 1 mL of water has a mass of 1 g. The **15.0 mL** of water you used would be **15.0 g**.

Mass of water = 15.0 g

The following formula will calculate **Kilocalories (Kcal)**. One kilocalorie = 1000 calories.

$$\text{Kilocalories of sample} = \left(\text{mass of water}\right)\left(\text{change in water temperature}\right)\left(\frac{1\ \text{Kg}}{1000\ \text{g}}\right)\left(\text{specific heat of water}\right)$$

The specific heat of water is 1 kilocalorie/Kg deg.C. So the formula would look like this.

$$\text{Kilocalories of sample} = \left(\frac{15.0\ \text{g}}{}\right)\left(\frac{{}^{o}\text{C}}{}\right)\left(\frac{1\ \text{Kg}}{1000\ \text{g}}\right)\left(\frac{1\ \text{Kcal}}{\text{Kg}\ {}^{o}\text{C}}\right)$$

You will see that all units of measurement except kilocalorie cancil each other out of the equation. Everything is already in the equation except your change in temperature for the water. Put in your change in temperature and work the calculation. You now have the total kilocalories of energy given off by the food sample.

Energy given off by sample = ________ Kcal

11. Calculate the kilocalories per gram of the food sample. This is the total kilocalories divided by the change in mass of the sample. The unit will be Kilocalories/gram.

Kilocalories per gram of sample = ________ $^{Kcal}/_{g}$

Now repeat the procedure with the next food sample. You may collect the data for all the samples, and then do the calculations. Use a clean test tube each time.

Compair the answer to step 11 for all the food samples.

FURTHER INVESTIGATION:

The calorimeter you used is very crude, and some of the energy was lost to the air. It will still give you a good comparison of different food samples. You might like to design a better calorimeter, and repeat the experiment.